The ecology and population biology of the critically endangered succulent - *Adenium swazicum.*

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Abstract

Southern Africa has large concentrations of threatened species when compared to the rest of the world and although many of these species are represented in nature reserves and protected areas, there is no guarantee of their effective conservation. *Adenium swazicum* is a succulent shrub belonging to the Apocynaceae family and has a near-endemic status ranging from the Kingdom of Swaziland in the south to the province of Mpumalanga, South Africa in the north. The International Union for the Conservation of Nature (IUCN) classified *Adenium swazicum* as critically endangered (CR) in its 2008 assessment, based on an estimated past and future habitat loss of 80% due to agriculture and exploitation of the plant for its medicinal properties. The Lowveld National Botanical Garden (LNBG) has a threatened plants project which is focussing on the ecology and population biology of *A.swazicum* in order to manage both *in situ* and *ex situ* collections effectively.

Keywords

Adenium swazicum, critically endangered, ecology, population biology, medicinal plant, Lowveld National Botanical Garden.

Adenium swazicum is a succulent, deciduous shrub from the Apocynaceae family which was described in 1963 by L.E. Codd (Flora of SA, 26), it has also been known by the homotypic synonym *Adenium boehmianum* Schinz var *swazicum* (Stapf) by G.D. Rowley, as described in the Cactus Succulent Journal (Los Angeles) 46 (4):164.

A.swazicum grows to a maximum height of 1.2m and occurs in low-laying sodic/brackish areas within deep clay soils and has a near-endemic status occurring in Mpumalanga, South Africa and Swaziland. As the common name, Summer Impala Lily implies, the plant produces its striking pink flowers during the summer months, which is from November to April, but it is not uncommon for flowering to continue to May. The IUCN classified *A.swazicum* as critically endangered in the latest IUCN Red List (Riamondo *et al*, 2008) based on past and future habitat loss of 80% with actual and potential levels of exploitation for its horticultural and medicinal properties. Although there have been no scientific studies into the medicinal uses and chemical composition of *A.swazicum,* other species in this genus are widely used for arrow poison (van Wyk & Gericke, 2000). The tuber of *A.swazicum* is extensively harvested throughout its distribution area and personal communication with traditional healers in Nelspruit, Mpumalanga, South Africa revealed that the tuber is boiled and the extract is drunk to cure stomach ailments.
Although most horticultural aspects of *A.swazicum* have been intensively studied, no studies have focussed on its population biology or ecology. As mentioned previously in the near future *A.swazicum* faces a serious risk of extinction outside protected areas, and although the plant occurs in the relative safety of the Kruger National Park, the extent of the population or ecological aspects are currently unknown.

LNBG has a dedicated threatened plants programme focussing on *ex situ* and *in situ* conservation of threatened plants in the summer rainfall areas of South Africa and since *A.swazicum* occurs within the same climatic conditions as the LNBG, this plant has become one of the garden's priority species with a three year monitoring programme focussing on population size and structure, regeneration aspects, biotic and abiotic aspects, as well as *ex situ* conservation research.

The programme was started in 2008 by obtaining historical distribution records from the South African National Herbarium and the herbarium at the Royal Botanical Gardens, Kew, UK. The aim is to conduct a full population count, but only fifty (50) plants in four (4) sub-populations are monitored in terms of the following:

- Plant size and growth: Once a year the height of the plant, maximum canopy diameter, diameter at right angles to maximum canopy diameter, and number of stems are measured to determine canopy cover and canopy volume.

- Regeneration capacity: The average number of flowers per plant per season is determined, as well as the total number of follicles produced. The ratio between flowers and follicles as well as number of seeds released per plant per season is calculated.

- Pollination aspects: The pollinator for the genus *Adenium* is still unknown (Rowly, 1980). Plants in *ex situ* collections at LNBG are not naturally pollinated even if the plants are left exposed. Initial pollinator studies have indicated limited insect activity around flowering plants during the day, and the hypothesis is that the plants are pollinated by a crepuscular insect.

- Determine the regeneration capacity of *A.swazicum*. Three (3) quadrats were established *in situ* to determine the seedling survival rate as well as herbivore impact on seedlings. All three (3) experimental quadrats were planted with 100 *A.swazicum* seeds which were harvested from the same sub-population during the previous seed season. The first quadrat was left exposed and all herbivores (mammals and insects) had access to the seed and seedlings. The second quadrat consisted of a 1m x 1m steel frame which was covered with 30mm poultry mesh to exclude mammals but allow insects access to seed and seedlings. The third quadrat also consisted of a steel frame which was covered with 30mm poultry mesh as well as mosquito net which excludes all mammals and insects. Quadrats were placed in corresponding positions in the veld with the same sun/shade exposure. Preliminary results indicated that less than 6% of the seed/seedlings survived in the exposed quadrat with as much as 57% survival rate in the quadrat which excluded all herbivores.

- Monitoring disturbance – Insect impact *in situ*. Data reveals that *A.swazicum* forms an important part of the insect ecology and is heavily utilized by various insect groups such as the leave beetle *Chrysolina (Naluhia) confluens* who uses the plant as a host species for larvae and adults, and the fruit fly *Dacus frontalis* which was responsible for up to 95% seed predation in 2009.

  With an *ex situ* collection of more than 2,000 flowering *A.swazicum*, LNBG is in the ideal position to test and monitor different disturbance regimes impacting on *A.swazicum*.

The disturbance regimes were conducted to simulate natural impacts such as the occurrence of fire and herbivores. Eighteen plants were selected and the experiments were done in September 2008 to coincide with the natural fire season. Six plants were covered with dry grass and burned to simulate natural fires, six plants were debarked at various scales to simulate the impact of grasshoppers, branches were removed to various degrees and lastly all the above-ground parts were removed from two plants, but the tuber was left undisturbed. In all the experiments, the plants recovered completely with some flowering in the same season.

- Establish propagation protocols. Seeds used for the propagation protocols were obtained from the natural populations as well as from hand-pollinated plants in LNBG. Variables tested included different soil mediums, water regimes, three different depths of sowing, germination success of seed of different ages and shading aspect.

Botanical Gardens have a wealth of experience and expertise when it comes to plants, their propagation and ecological processes. This information can provide essential *in situ* conservation support to many threatened species. Well managed living *ex situ* collections provide invaluable opportunities to determine aspects which are difficult to determine in nature such as optimum germination temperatures, soil medium and the effect of different watering regimes on seed germination and seedling establishment.

References

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